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Abstract

RETENTION OF FISSION PRODUCTS BY PEAT-HUMIC ACIDS, A NEW POSSIBILITY IN WASTE WATER TREATMENT

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Earlier investigations in this institute revealed that uranyl cations are strongly sorbed on insoluble humic acids and this sorption is responsible for the known geochemical association of uranium with fossil plant substances. The sorption is a cation exchange process, being effective not only for uranyl, but for many other cations of higher atomic weight.

Peat is a very cheap abundant source of the insoluble humic acids, because it consists nearly up to approximately the half of them. The behaviour of peat humic acid preparations is comparable to that of synthetic cation exchange resins of the carboxylated type.

The authors investigated the retention of fission products on peat preparations in laboratory tracer experiments. The experiments demonstrated that the majority of the fission products, the cations, are strongly fixed on peat humic acids if approximately favourable conditions are secured. The fission products can be classified according to their fixation on humic acids into the following groups:

(a) Cationic fission products. The majority of the long-living biologically dangerous fission products are cations and are firmly fixed, e.g. rare earths, Zr, Sr, Cs.

(b) Anionic fission products (I, Ru, Se, Nb, Sb, Te, etc.) and inert gases are not fixed on humic acids, not even in tracer amounts.

For an efficient binding the pH of the aqueous phase must be kept between limits of about 4-6, optimally at about 5.

Elution sequence of the long-living cationic fission products has been investigated and the so-called "breakthrough volume" determined under optimal laboratory conditions from chemically pure tracer solutions.

The application of insoluble peat humic acid for the cation exchange decontamination of medium or lower activity waste waters of the atomic industry seems to be extremely attractive. Millions of tons of peat are available in nature in the temperate and northern zones. The sorption capacity of one ton of peat is roughly about one thousand chemical equivalents. This is sufficient for the fixation of megacuries of Sr and Cs. The breakthrough volume, that is the tolerable amount of waste water, filtrable by a given quantity of peat is about 1000 - 10 000 times its quantity, if optimum conditions are secured.

Further investigations of the authors concerned the possible interference of various non-radioactive chemical contaminants which might be present in industrial waste waters. The presence of salts, complexing agents and detergents can cause displacement or even remobilisation of the sorbed fission products. The breakthrough volume is decreased resp. the necessary quantity of peat is increased by the presence of them, if their concentration is excessive.

The volume and weight of the contaminated peat humic acids can be reduced to a very small fraction by incineration before ultimate disposal.